

Space Point Service Update

LArcSoft Meeting

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Outline

- Technical changes regarding use of mc truth information in SpacePointService.
- New 3D event display window.
- Adding errors to space points.

Use of MC Truth in SpacePointService

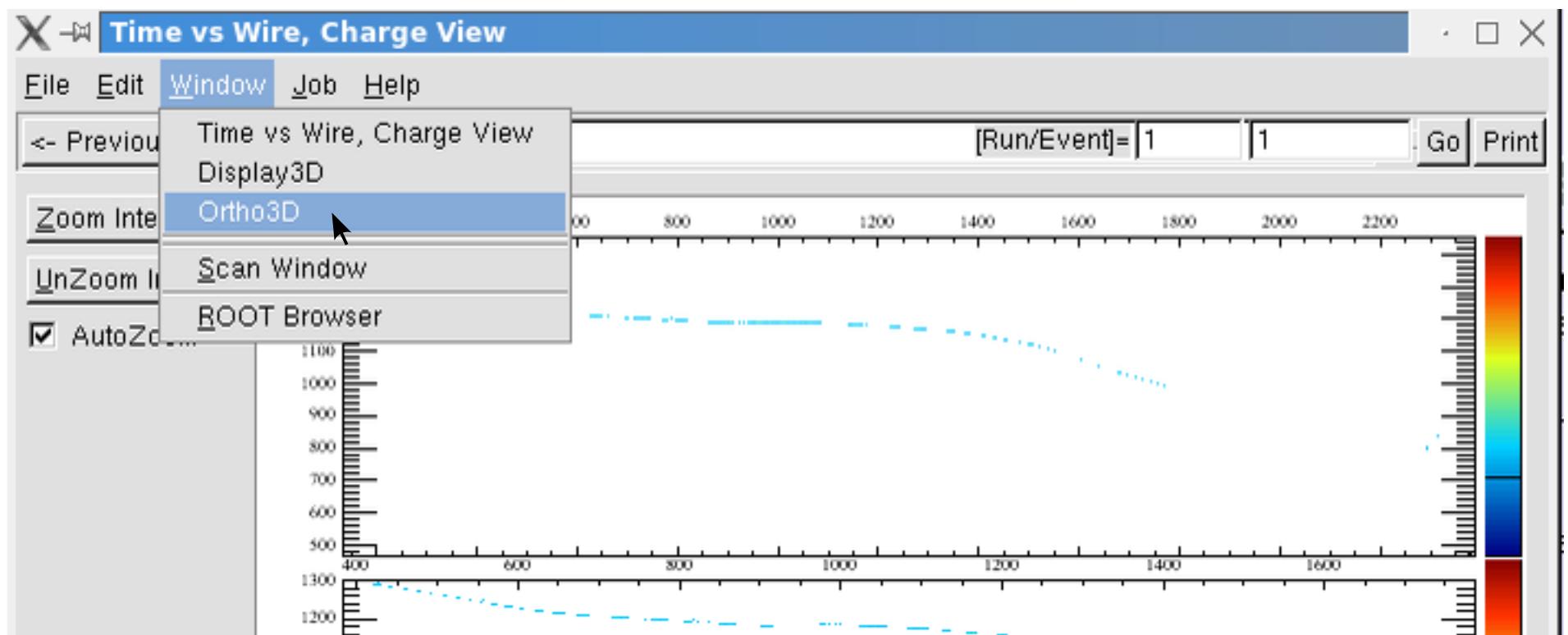
- Fcl parameter UseMC has been removed from SpacePointService.
 - Intended to reduce chance of using mc truth by mistake.
 - Same functionality still exists (it's too useful to get rid of), but now is invoked by calling different methods.

```
void makeSpacePoints(const art::PtrVector<recob::Hit>& hits,
                     std::vector<recob::SpacePoint>& spts) const;
void makeMCTruthSpacePoints(const art::PtrVector<recob::Hit>& hits,
                            std::vector<recob::SpacePoint>& spts,
                            const std::vector<const sim::SimChannel*>& simchans) const;
```

- Separate producer modules SpacePointFinder (non-mc-truth) and SpacePointCheater (mc truth) for storing space points in prongs.
- Track3DKalmanSPS is not using mc truth. Would need to be modified to use mc truth method.

New 3D Event Display Window

- In view of the problems and general clumsiness of current OpenGL full 3D event display, I wanted another way to visualize 3D objects (space points).
 - New 3D display window called “Ortho3D”.



Ortho3D View Features

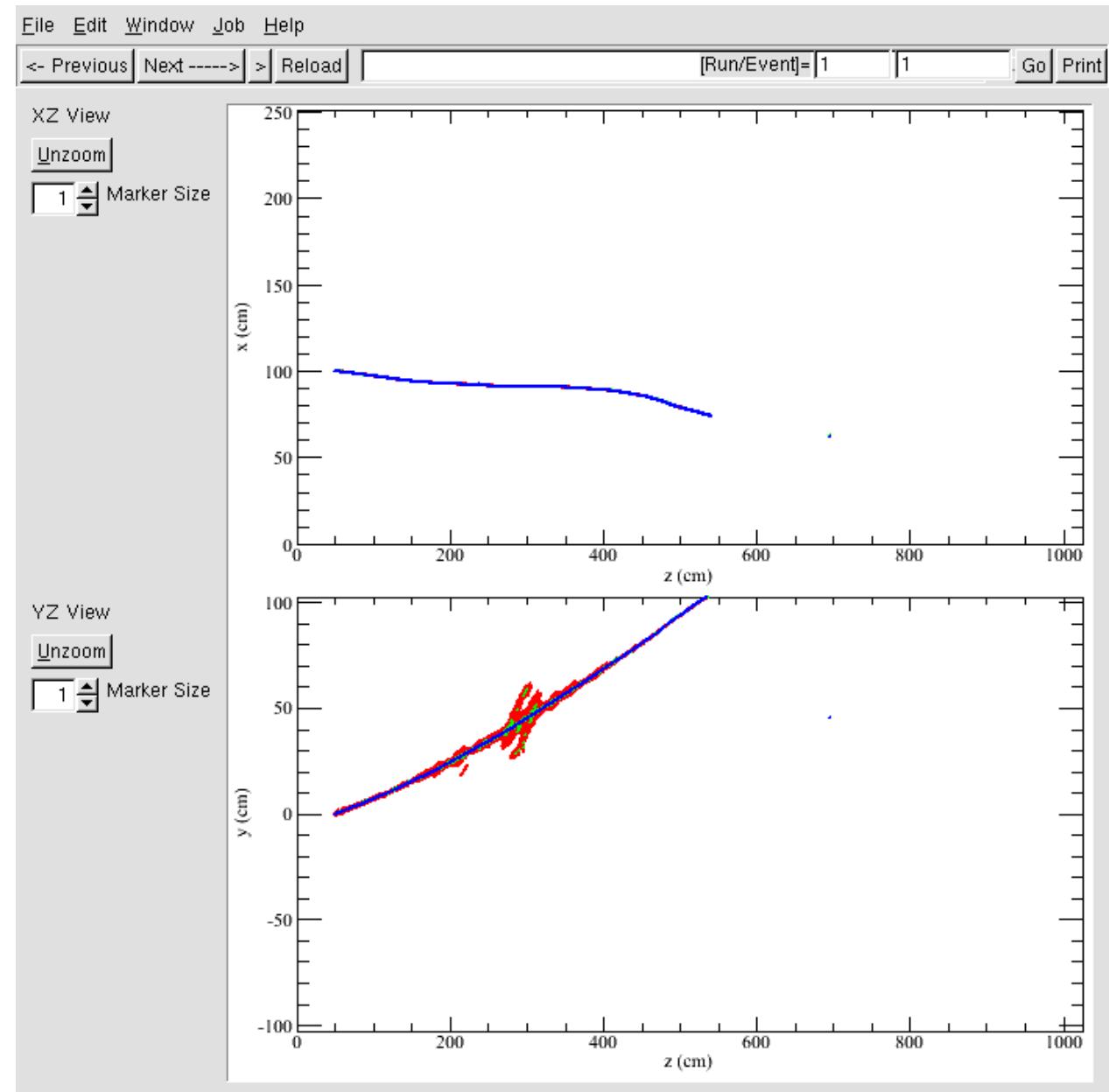
- Display space points stored in prongs.
 - Use SpacePointFinder or SpacePointCheater modules to make prongs.
- Two orthographic views currently: XZ and YZ.
- Zoomable
- Adjustable size markers (useful feature of OpenGL 3D display).
- Color options (also available in full 3D display).
 - Default – different colors for different prong objects.
 - By type (`ColorProngsByLabel = 1`) – different colors for different types of prongs (e.g. regular vs. mc truth prongs).
 - By chisq (`ColorSpacePointsByChisq = 1`) – generate color according to space point chisquare (not in svn).

Ortho3D View

XZ view

(looks similar to
time vs. wire view)

YZ view



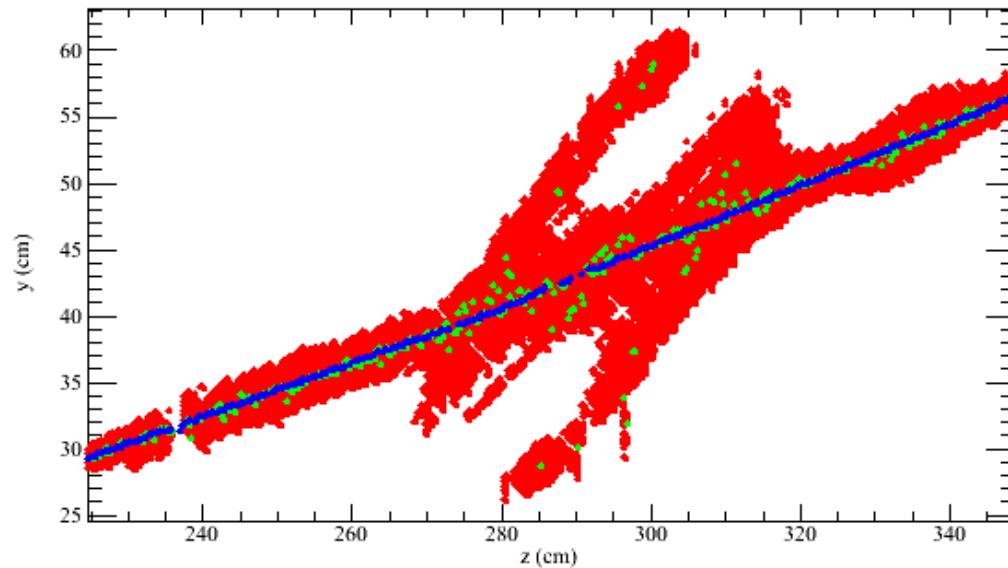
Ortho 3D View Color Options

Color by type

Blue = Truth

Green = Filtered

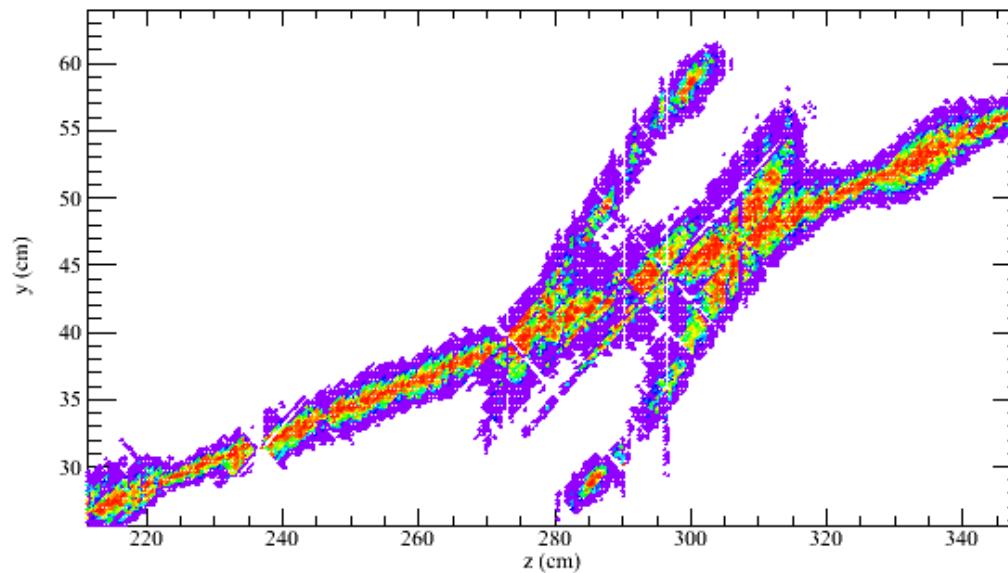
Red = All



Color by chisquare

Red = Better

Blue = Worse



Adding Errors to Space Points

- Space Points currently have as attributes a list of hits (art::PtrVector<recob::Hit>) and spatial coordinates (x,y,z).
- Proposal: add the following attributes.
 - Error matrix (3x3 symmetric matrix – 6 values).
 - Chisquare.

Calculating Space Point Errors (Ideal Case)

- σ_x based on error propagation from time error of hits.
- σ_y, σ_z based on error propagation from wire positions.
 - $\sigma = \text{pitch} / \sqrt{12}$.
 - Three-hit space points with symmetric geometry get diagonal error matrix.
 - Other kinds of space points (e.g. two-hit space points) will normally have correlated errors in the yz -plane.
- Chi-square calculation based on hit times only.
 - All good space points have the same separation.

Space Point Pulls Using Ideal Errors

